

easylearning

Easy **C**atching **g**athering

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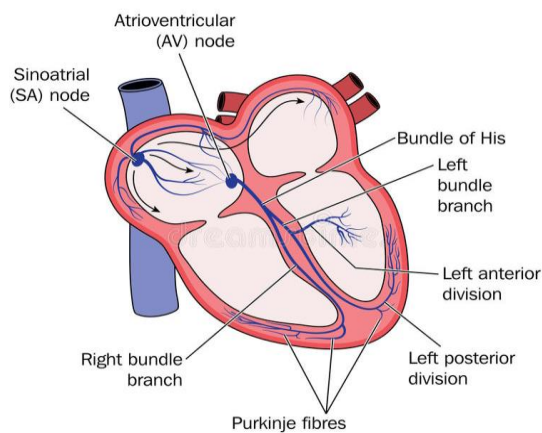
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Dr. Najwa AL moalwi

How to read ECG

✚ **Electrocardiogram:** A recording of the electrical activity of the heart. Abbreviated **ECG** and **EKG**. An **ECG** is a simple, noninvasive procedure. Electrodes are placed on the skin of the chest and connected in a specific order to a machine that, when turned on, measures electrical activity all over the heart

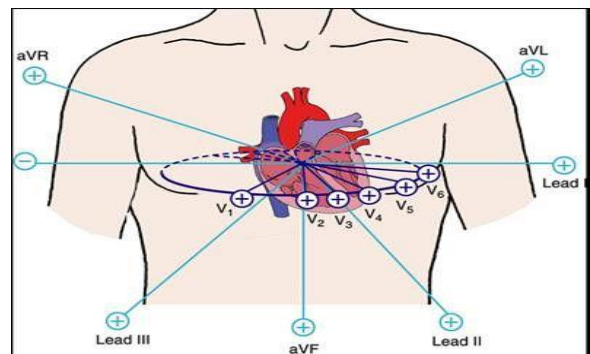
✚ **The pathway of heart electrical:**



✚ **We have 12 lead ECG:**

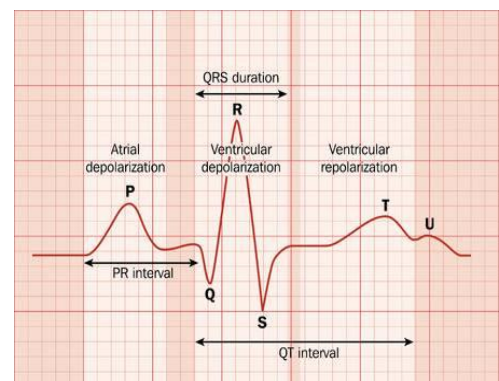
as you can see in picture :

- i. lead I,II,III
- ii. lead aVL ,aVR ,aVF
- iii. lead v1,v2,v3,v4,v5,v6.



✚ **representation :**

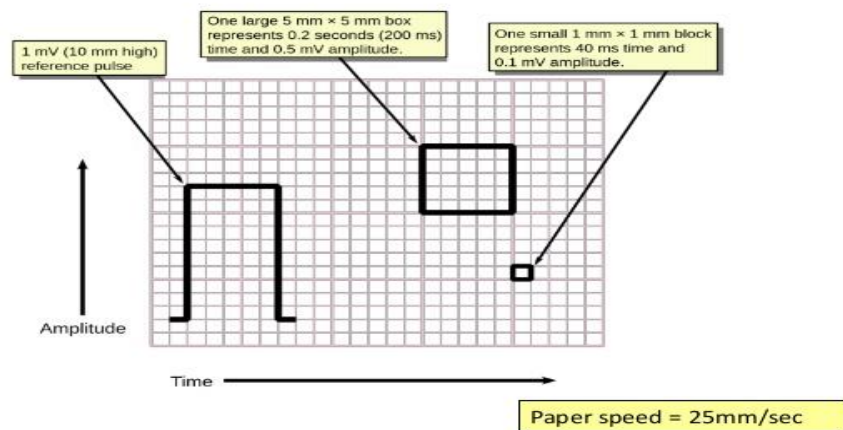
- i. p wave (atrial depolarization)=contraction.
- ii. QRS complex (ventricular depolarization)=contraction.
- iii. T wave (ventricular repolarization)=relaxation.



First of all check :

- The patient data (name , age , file number ... ect) is belong to you patient not other one .
- ECG machine calibration (amplitude, speed).

Standardization



R-R-LAW

RATE:

You have tow way to calculate the rate:

If it was **regular** : 1) 300/number of large square between R and R wave.

Or 2) 1500/ number of small square between R and R wave.

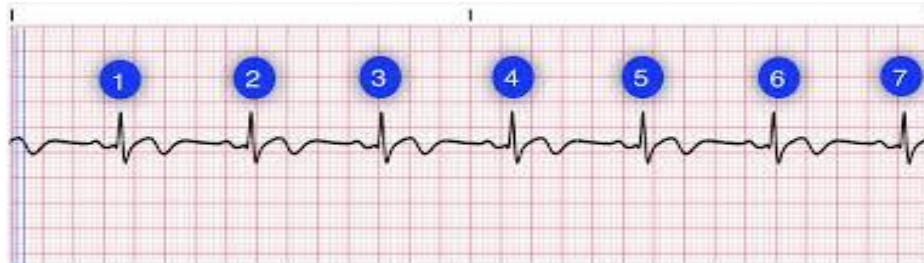


$$\text{Heart Rate} = \frac{300}{4} = 75 \text{ per minute}$$

Eg;

If it was **irregular** : calculate large 30 square and then see how many R wave in these square multiplied by 10.

Eg;



There is 7 R wave in 30 large square .so, $7 \times 10 = 70$.



Rhythm:

- ✓ See in lead II
- ✓ To fine if this regular or irregular rhythm you can use ---- paper test



- ✓ To say this is **regular** rhythm you need to find single P wave in front of each QRS complex.
- ✓ **Sinus** rhythm either **tachycardia**(heart rate more than 100 BPM) or **bradycardia** (heart rate less than 60 BPM) but there should be there single P wave in front each QRS complex in lead2.



Lines:

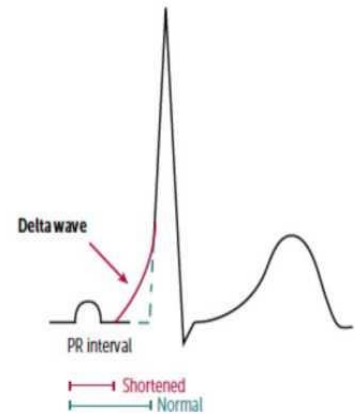
✓ **P-R interval :**

See it in lead II , you will calculate from the beginning of the P wave to the R wave , and the normal is 3-5 small square .

wolf Parkinson white syndrome <3-5 small square > heart block

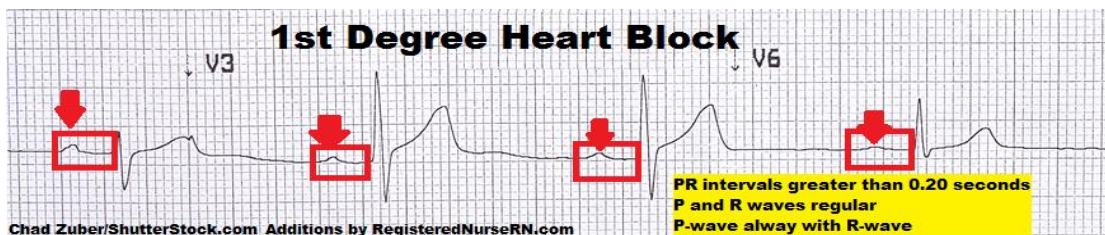
1) wolf Parkinson white syndrome

- PR interval short < 3 SS.
- Delta wave – slurring slow rise of initial portion of the QRS.
- QRS prolongation >2 large square.
- ST Segment and T wave discordant changes – i.e. in the opposite direction to the major component of the QRS complex
- Pseudo-infarction pattern can be seen in up to 70% of patients

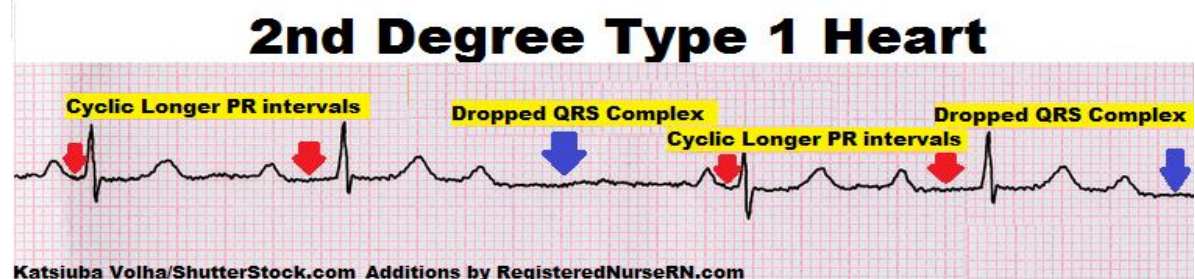


2) heart block :

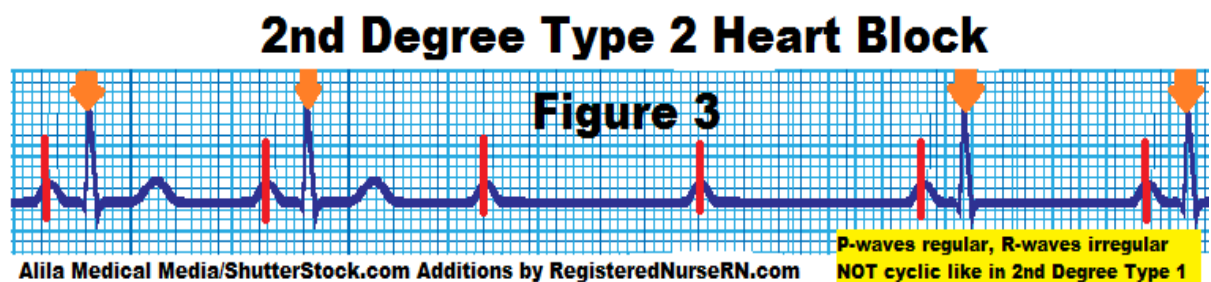
1)First degree HB :All normal P waves are followed by QRS complexes, but there are fixed longer PR interval than normal. Treatment: no need . .



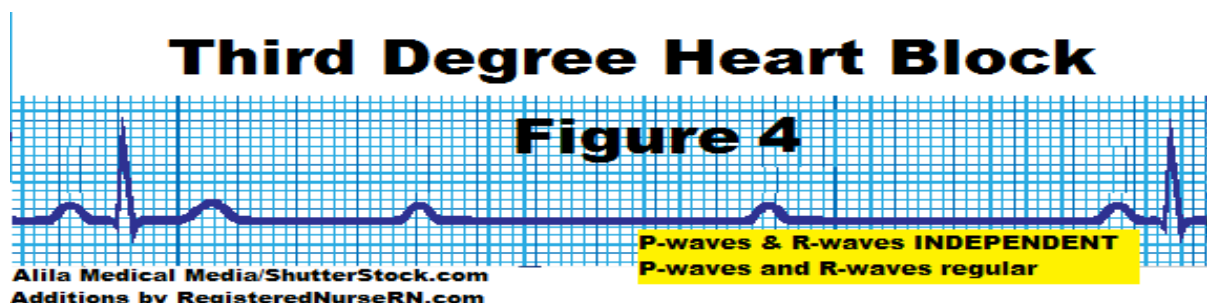
2) Mobitz type I: 2nd-degree AV block, the PR interval progressively lengthens with each beat until the atrial impulse is not conducted and the QRS complex is dropped (Wenckebach phenomenon). Treatment :no need



2) Mobitz type II: 2nd-degree AV block, the PR interval remains constant. Beats are intermittently nonconducted and QRS complexes dropped .
treatment :pacemaker .

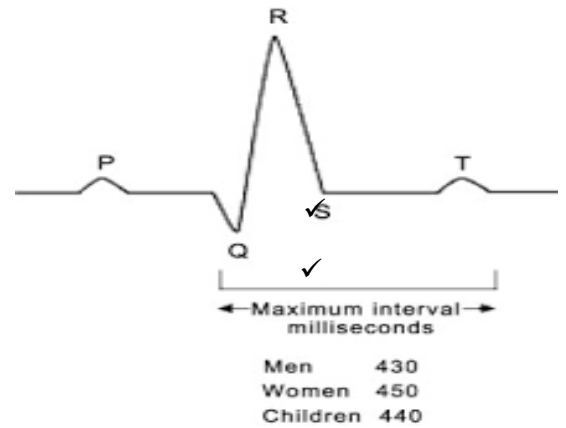


3) Third degree HB: There is no electrical communication between the atria and ventricles and no relationship between P waves and QRS complexes (AV dissociation). Treatment : pacemaker-



✓ QT interval :

Seen in lead 2,V5 and V6 2 large square
start of the Q wave and the end of the T wave.



- Prolonged QT interval caused by some drugs:

Table 2				
Drugs Associated with QT Prolongation and TdP				
Antiarrhythmics	Antimicrobials	Antidepressants	Antipsychotics	Others
Amiodarone	Levofloxacin	Amitriptyline	Haloperidol	Cisapride
Sotalol	Ciprofloxacin	Desipramine	Droperidol	Sumatriptan
Quinidine	Gatifloxacin	Imipramine	Quetiapine	Zolmitriptan
Procainamide	Moxifloxacin	Doxepin	Thioridazine	Arsenic
Dofetilide	Clarithromycin	Fluoxetine	Ziprasidone	Dolasetron
Ibutilide	Erythromycin	Sertraline		Methadone
	Ketoconazole	Venlafaxine		
	Itraconazole			

Source: References 1, 3, 4, 8, 9, 14.

,hypocalcaemia. hypomagnesemia,

- Short QT interval : short QT syndrome , digoxin toxicity or hypercalcemia.

✓ ST segment :

See it in this lead ----- **V1,V2,V3,V4**----anterior.

V1,V2 -----septum

leadI,aVL,V5,V6—latral

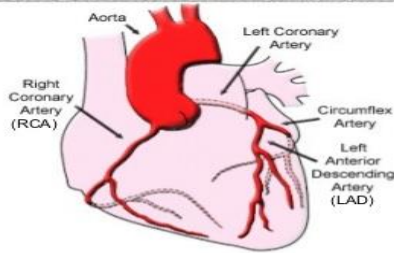
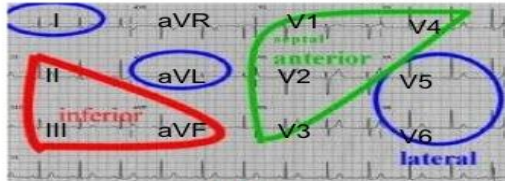
lead II,III,aVF-----inferior

- Elevated in all leads ----->**pericarditis**.
- Depressed in all leads ----->**digitalis effect**.
- Depressed in some lead ----> **V1,V2,V3,V4**----anterior MI.
V1,V2-----septum MI.
leadI,aVL,V5,V6—latral MI.
lead II,III,aVF-----inferior MI.

ST-SEGMENT

Localizing MI

Look at ST changes, Q wave in all leads. Grouping the leads into anatomical location, we have this:



Ischaemic change can be attributed to different coronary arteries supplying the area.

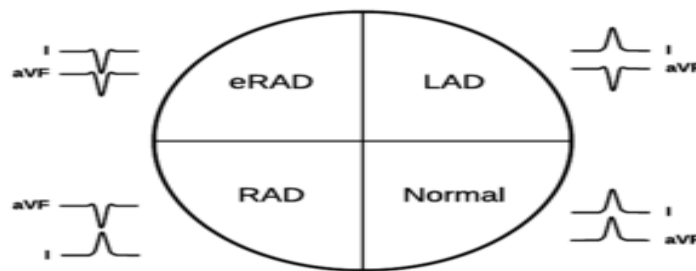
Location of MI	Lead with ST changes	Affected coronary artery
Anterior	V1, V2, V3, V4	LAD
Septum	V1, V2	LAD
left lateral	I, aVL, V5, V6	Left circumflex
inferior	II, III, aVF	RCA
Right atrium	aVR, V1	RCA
*Posterior	Posterior chest leads	RCA
*Right ventricle	Right sided leads	RCA

*To help identify MI, right sided and posterior leads can be applied

Axis:

See the R wave in lead 1 and lead AVF:

1. If all +ve its normal
2. If +ve in lead 1 and -ve in lead AVF its left axis deviation.
3. If -ve in lead 1 and +ve in lead AVF its right axis deviation



LAD=left anterior hemi block

RAD=left posterior hemiblock

Waves:

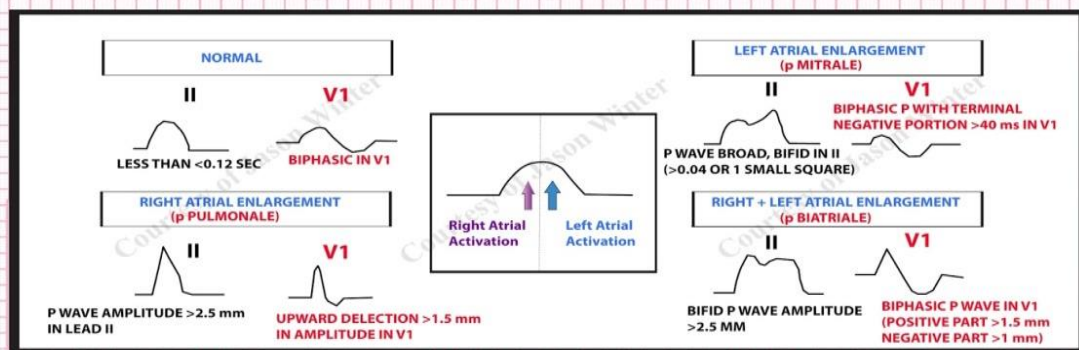
- ❖ **P wave** : see it in lead II.
- location—precedes the QRS complex
 - amplitude—2 to 3 mm high(2 small square)
 - duration—0.06 to 0.12 second(2 small square)
- deflection—positive or upright in leads I, II, aVF, and V2 to V6;

ECG by dr.Majed AL saleh FM consultant & dr. Najwa AL moalwi

usually positive but variable in leads III and aVL; negative or inverted in lead aVR; biphasic or variable in lead V1.

1. Tachycardia with multiple p wave (atrial flutter)
2. Tachycardia with absent p wave (atrial fibrillation)
3. P wave **wide** >2.5 mm in lead II or biphasic in V1 (P.mitrale) left atrial enlargement .
4. P wave **peaked** >2.5 mm in inferior lead II,III and aVF (p. pulmonale) right atrial enlargement .
5. Multiple morphologies P wave (multiple atrial tachycardia)MAT common .

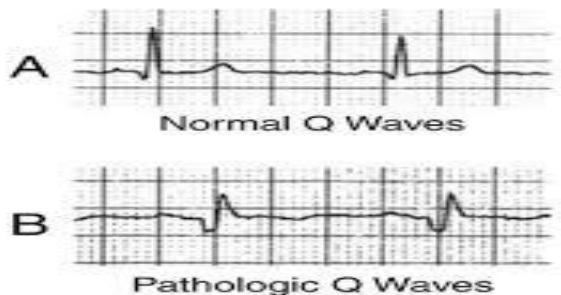
Common P wave Abnormalities



* THINK IS THE P WAVE TOO TALL (>2.5 mm) OR IS THE P WAVE TOO WIDE (2 SMALL BOXES), THEN CONSIDER ATRIAL CHAMBER ENLARGEMENT.

❖ Q wave :

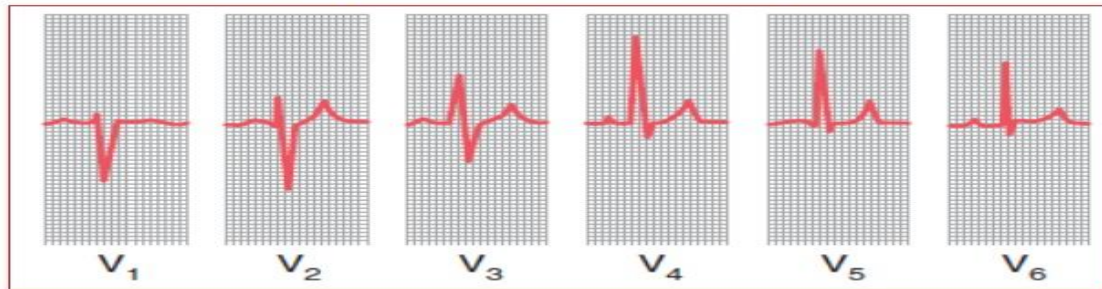
Is the first negative deflection after P wave . normal is 1 small square and the pathologic Q wave is sign of previous MI



❖ QRS complex :

- location—follows the PR interval
- amplitude—5 to 30 mm high but differs for each lead used
- duration—0.06 to 0.10 second, or half of the PR interval (1 large square).
Duration
- is measured from the beginning of the Q wave to the end of S wave.
- You should know the QRS waveform variety.

CHEST LEADS (PRECORDIAL LEADS)



Normal ECGs of chest leads

- if it narrow < 1 large square its suggest the complex is originated from supra ventricular eg :
 - atrial fibrillation.
 - atrial flutter
 - MAT " multiple atrial tachycardia".
 - PAT " paroxysmal atrial tachycardia.
 - PSVT " paroxysmal supra ventricular tachycardia ".

Type	Identifying Features	Appearance (Lead II)	Clinical Notes
Atrial			
Premature Atrial Contractions (PAC)	Premature P waves (abnormal or inverted), short T-P interval before beat, long T-P after beat		May confuse with Premature Nodal Contraction.
Premature Atrial Tachycardia (PAT, PSVT)	Rate 150-250/min, P waves abnormal or buried. Called supra-ventricular tach (SVT) and may be paroxysmal.		Sudden onset and termination. Patients may experience lightheadedness or palpitations. May lead to ↓BP/CO, myocardial ischemia, CHF.
Atrial Flutter	Atrial rate 250-350/min, ventricular rate normal, sawtooth P waves, 2:1, 3:1, 4:1 block of QRS		Commonly associated with pulmonary disease. May return to normal or deteriorate to A-fib. ↑ risk for embolism.
Atrial Fibrillation (A-fib)	No clear P waves, atrial rate 350-450/min, irregular ventricular rhythm		Often asymptomatic, except ↓ cardiac reserve. ↑ risk for embolism.

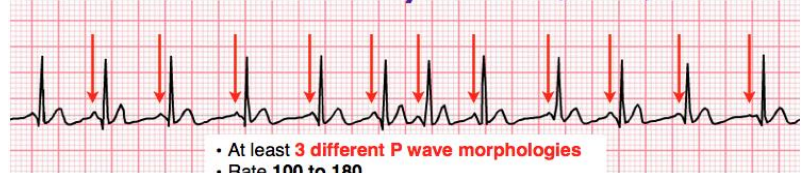
- If it is wide >2 small square its suggest the complex is originated from ventricle eg: ventricular tachycardia

Ventricular Fibrillation



- Completely **disorganized**
- Immediate cessation of cardiac output, **no associated pulse**
- No discernible P waves, QRS complexes, or T waves
- **Incompatible** with life

Multifocal Atrial Tachycardia (MAT)



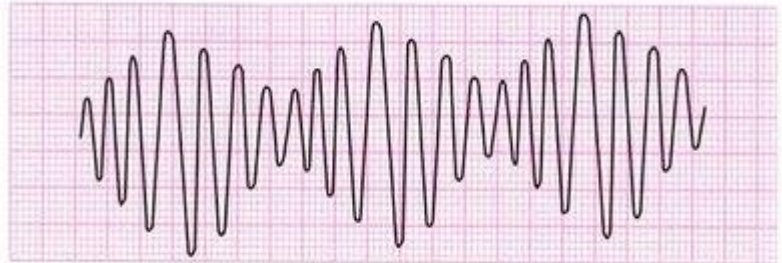
- At least **3 different P wave morphologies**
- Rate **100 to 180**
- **Irregular**

Ventricular Tachycardia

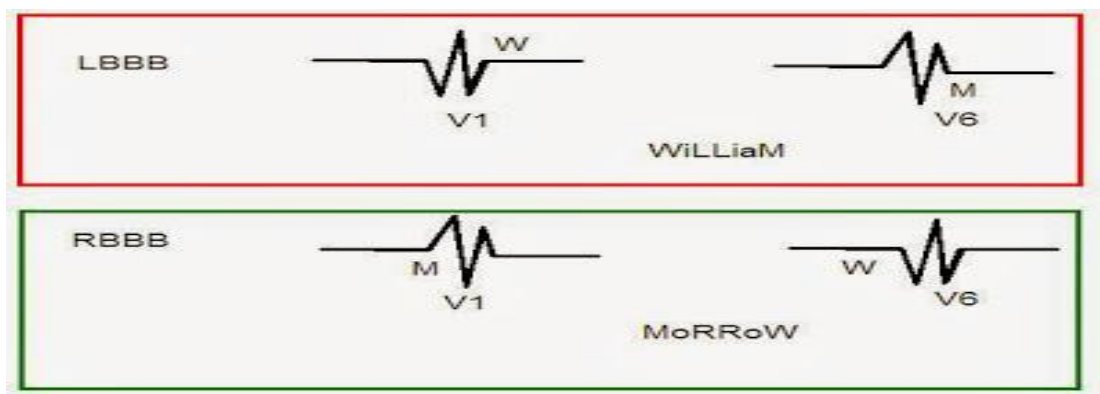


- **AV dissociation**
- QRS >120 msec (**wide complex**)
- **Rate >100** (typically 150-200)
- **Fusion** beats
- **Capture** beats

Torsade de Pointes



- If R wave is notched in lead v5 & v6 ----->left BBB.
- If R wave wide(M shape or **bunny ears**) in lead v1& v2----->right BBB.



Type of heart block :

1. First degree heart block
2. 2nd degree heart block type 1 and type 2.
3. 3rd degree heart block.
4. Right BBB
5. Left BBB
6. LAHB(left anterior hemi block) = left axis deviation.
7. LPHB(left posterior hemi block)= right axis deviation .
8. bifascicular block---RBBB with either LAHB or LPHB.
9. tri fascicular block --- RBBB+ LAHB or LPHB + first-degree AV **block**.

- Ventricles enlargement : 1)left ventricular enlargement :
 Deep S in V1 & V2 more than 5 squares.
 or Tall **R** in V5 & V6 more than 5 squares.
 2)right ventricular enlargement :
 Tall **R** wave in V1& V2 more than 5 squares
 Or deep S wave in V5&V6 more than 5 squares

❖ T wave:

- location—follows the QRS complex .
- amplitude—0.5 mm in leads I, II, and III and up to 10 mm in the precordial leads
- configuration—typically round and smooth
- deflection—usually upright in leads I, II, and V3 to V6; inverted in lead aVR; variable in all other leads.
- Tall, peaked, or tented T waves indicate myocardial injury or hyperkalemia like tour Eiffel.
- Inverted T waves in leads I, II, or V3 through V6 may represent myocardial ischemia like strain.
- Heavily notched or pointed T waves in an adult may mean pericarditis

